Editor's Note: This is the second of two papers by Dr. Mathieu on the subject of "Pregnancy Tests and the Value of Sedimentation of Erythrocytes in Gynecology and Obstetrics." The first division on "Pregnancy Tests" appeared in the November issue.

FAHRAEUS made observations on the phenomenon of the sedimentation of the red cells of the blood many years ago, but Linzenmeier was the first to publish concerning this test in its relation to gynecology and obstetrics. It is of relatively minor value as a test for pregnancy in that it can in no way clinch a diagnosis of pregnancy. Nevertheless, since after the third month of pregnancy there is an increase over the normal sedimentation distance, and since this sedimentation distance increases with each succeeding month of pregnancy, so that at the tenth month the average sedimentation distance is 35 mm. in one hour, one can readily see that it can be used as an aid in the diagnosis of pregnancy. Its significance is so great that special consideration will be given here to its general obstetrical and gynecological application.

The older test for "sedimentation time" consisted in the dilution of blood with one part to five of 2% sodium citrate to inhibit clotting, and with the blood in a special tube, the determination of the time required for the solid contents of the blood to settle. The time was formerly the criterion of this test, but since the time test was so cumbersome Gippert conceived the idea of measuring speed, hence distance, in one hour, with very simple tubes, and this no doubt will be the method universally used. In measuring sedimentation time, one might have to watch the tubes for several hours, while on the other hand the relative value of the test is as truly significant if the sedimentation is watched in this new type of tube and measured over a period of one hour.

Linzenmeier found the following sedimentation times:

- Longest in newborn: 24 hours for 18 mm.
- Next in elderly man: 4 to 8 hours
- Next in elderly woman: 3 to 6 hours
- Next in pregnant woman: 30 minutes

While the following are the standards of distance for one hour with the tubes shown in Figure 1:

- Newborn: 1 mm. in 1 hour
- Elderly man: 3 to 6 mm. in 1 hour
- Elderly woman: 4 to 9 mm. in 1 hour
- Pregnant woman: 35 mm. in 1 hr.
- Fever or infection: 35 to 38 mm. in 1 hr.

The tube (Figure 1) is a very simple one having only two marks, one for the citrate solution level and the other for the blood level. There are no marks on the tubes for reading sedimentation distance. This is done by using ordinary graph paper ruled in millimeter squares. With these tubes, very little blood is needed. The tube can be filled to the citrate marking by merely dipping it into the solution; then the blood is sucked in and up to the mark for the blood, and the two are mixed by sucking the blood and citrate solution back and forth in the tube several times. One must be sure that there are no air bubbles in the mixture. After the blood and citrate solution are well mixed, the lower end of the tube is plugged with common soap and the tube is stood up.
in a rack where it can be watched. A hole in a cork or such similar device is all that is needed to hold the tube in vertical position. The following are observations pertaining to technique, reading, and the significance of the test.

1. Blood sediments slowly at first but speeds up toward the end.
2. The shortest distance of all is noted in infectious disease when it drops to 35 mm.

3. In the post-partum stage, the sedimentation distance returns to normal in six to ten weeks after delivery if everything is normal.
4. During pregnancy the test is of no value except that the pregnancy advances the distance of sedimentation increases until it reach 35 mm. in the tenth month.
5. Every person has a normal sedimentation distance in health and it should remain so for that person. For this reason the test may be kept as a standard.

6. One may rule out active infections if the sedimentation distance is normal.
7. If the sedimentation distance is more than 8 mm. in one hour (which corresponds to one and a half hours of the old reading of sedimentation time) there is infection, except in pregnancy.

8. The sedimentation distance test is more delicate than the leucocyte count and is to be accepted in preference to the leucocyte count. This test can be used in appendicitis with even more confidence than is now placed on the leucocyte count.

9. Normal blood shows a straight line at the top, as in Figure No. 1, while pathological blood separates out in a cloudy manner.

10. The sedimentation distance is altered by malignancy, especially degenerating cancer. In cancer the distance is usually about 20 to 25 mm. If any operation is successful, the sedimentation distance will be normal in six weeks and if not there probably will remain remnants of dead tissue or infectious material.

11. In inflammation there are two components:

   A. Exudative Component:
      - Exudation,
      - Hyperemia,
      - Swelling, etc.

   B. Productive Component:
      - Granulation,
      - Scar,
      - Cirrhosis,
      - Healing, etc.

   During the period of predominance of the Exudative component, the sedimentation distance acts as it would during infection or inflammation; that is, the distance is prolonged.

   During the period of predominance of the Productive component, the sedimentation distance is normal or rapidly approaching normal.

12. Decomposition of tumors alters the sedimentation distance as does the x-ray treatment of cancer. It increases in mm. per hour.

13. Foreign protein substances also increase the sedimentation distance such as:

   - Protein Injections
   - Peptone
   - Milk
   - Protein Injections
   - Peptone
   - Etc.

14. The sedimentation distance test has little value in ectopic pregnancy except in the differential diagnosis between ectopic pregnancy and acute and sub-acute salpingitis. (The distance is long in infections of the tubes and short in ectopic pregnancy.) It is too early for the test in the seventh or eighth week of ectopic pregnancy and at three months it shows no difference from cystic tumors and adnexal tumors. These tumors vary in sedimentation distance as does ectopic pregnancy and one cannot make a differential diagnosis by this test.

15. If the sedimentation distance increases after abortion or confinement, this is significant of infection or retention.

These observations are only tentative and may be subject to alteration after further study.

The sedimentation distance is increased in one physiologic condition—pregnancy. In this condition, after the second month, sedimentation distance increases with each succeeding month of pregnancy until the distance is approximately 35 mm. at term. Various workers have used the sedimentation (time or distance) of the red blood cell in many different ways—each using different tubes and a different technique.

Results, therefore, have been varied. Nevertheless, these workers have all agreed that the test has marked clinical value. Cutler uses it particularly in the estimation of activity of tuberculous infection. Three years ago, Dr. Theodore Adams instituted the use of sedimentation time in the Gynecological Service of the Multnomah Hospital, and has written admirably on his work there. Ever since that time we on the Gynecological Service at the Multnomah Hospital have made this test a very prominent criterion as to when to operate in salpingitis. Formerly we allowed our salpingitis patients to 'cool' and would not operate on them until the temperature and leucocyte count had been normal for ten to fourteen days. Then we included the sedimentation as the predominant criterion—not choosing to operate until the sedimentation time became normal. We learned that certain
patients with a normal temperature and apparent inability to maintain a protective leukocytosis still had abnormal sedimentation rates indicative of some degree of activity. We have reached the conclusion, absolutely corroborated by our records, that it is best to wait until the temperature, leukocyte count and sedimentation distance have reached normal for a period of at least ten days. Since acquiring these criteria as to when to operate, our mortality rate in this type of infection has been zero.

Since this work was done I have adopted the modified Westergren technique and tubes worked out by members of the Bio-chemistry Department of the University of Oregon Medical School for use with oxalated venous blood. This method was demonstrated as a part of their Uniform System of Hematologic Methods in the Scientific Exhibit at the July meeting of the American Medical Association in Portland and will be published before long. This method is giving great satisfaction. A full report of extensive studies in sedimentation distance being made in conjunction with the originators of the modified method, will appear later.

545 Medical Arts Bldg.

Reprint from The Medical Sentinel, December, 1929

We have gathered a vast store of knowledge from the study of the shadows produced upon a sensitive recording medium by the varying grades of density of human tissues. Starting with bones, we have gone on to methods which visualize in shadow, the kidneys, the spleen, the gall-bladder, and the bronchi. Further, we have visualized cavities by the introduction of opaque media. The stomach and bowel, the urothel, the kidney pelvis and the bladder have long been observed in silhouette. It is cause for wonder, then, why the genital tract, so often the seat of pathology, has not earlier been subjected to such studies.

Certainly the use of the X-ray in gynecologic diagnosis has been tardy in its development. There is no doubt but that this lack of progress hinges on the fact that opaque fluids injected into the uterus may find their way into the abdominal cavity, provided the tubes are patent. In earlier studies gas was apparently thought safer, and from 1919 on the pelvic organs were studied by means of pneumoperitoneum by Goetsch, Weber, Steward and Stein, Dryoff and Peterson and Crew, and many others. This method, however, entailed the dangers consequent upon the invasion of the abdominal cavity. There was always the possibility of puncture of the viscera and other dangers. These potentialities plus difficulty of interpretation without visualization of the cavities of the uterus and tubes, rather put the method into the discard. The dangers, which were real, were as follows: Puncture of the abdominal wall and the viscera, subcutaneous emphysema, peritoneal infection, and embolism. Rubin, who devised the means of placing gas within the abdominal cavity through the uterus and tubes, became distracted...